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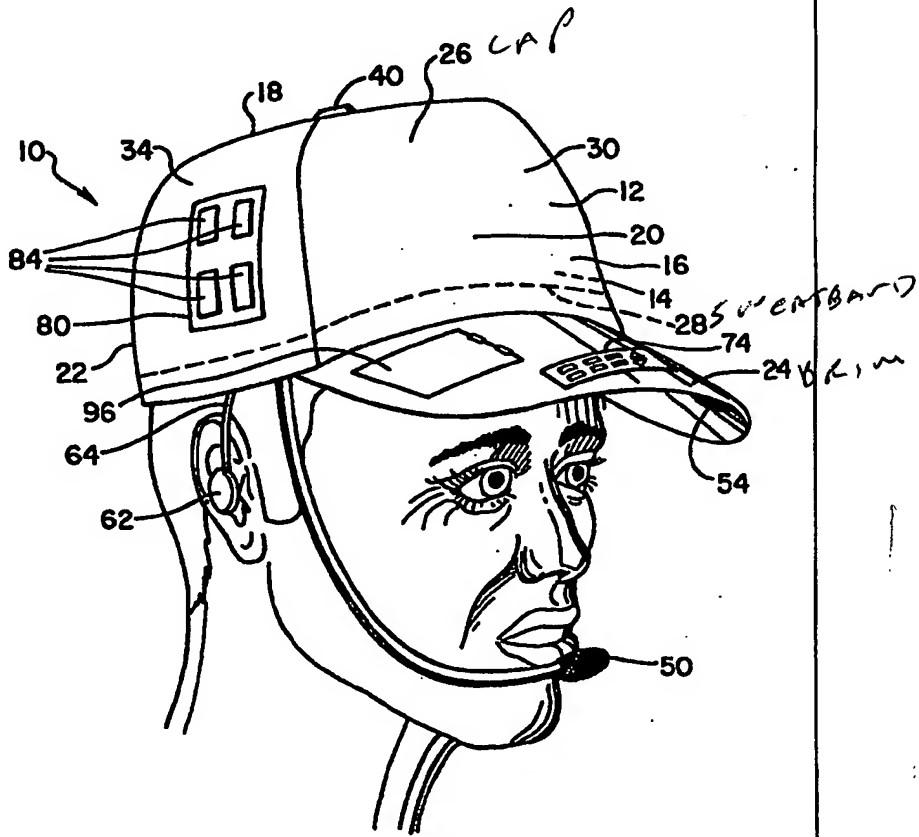
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(54) Title: COMMUNICATIONS DEVICE

(57) Abstract

A communications device (10) for use in aviation and other applications comprising a flexible, billed hat positionable over the hat of a person, the hat including electronic components located in its bill (24), its crown (26), and its headband (28). These electronic components may be incorporated into flexible printed circuit boards. An electrical connector comprising a Velcro® pad (80) fixed to the cap in combination with a removable Velcro® pad (84) attached to a cord which is capable of being connected to a control panel is included. Alternatively, batteries may be used as a power source. The communications device may be used as an aviation headset, a walkie-talkie communications device, a stereo/radio, a cellular telephone, a head top computer, or the like. Controls for volume, channel or frequency selection could be placed on the bill (24) or sides of the device.



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## COMMUNICATIONS DEVICE

### Background of the Invention

This invention relates generally to communications devices and more particularly to a personal communications device incorporated into an article of clothing, i.e. a hat or cap.

### Description of Related Art

With the miniaturization of electronics, there has been a substantial increase in the availability of portable electronic devices that people can utilize or enjoy while involved in an activity. Headgear structures have previously incorporated communications equipment such as a microphone and earphones. Examples of these devices are listed below.

U.S. Pat. No. 3,786,519 issued to Aileo on January 22, 1974 relates to a solid, inflexible helmet for use by aircraft carrier flight deck personnel (col. 5, lines 42-45). The helmet supports two-way voice radio or telephone communication and includes earphones, a boom microphone and Velcro® fasteners (col. 10, lines 58-62; col 11, lines 2-5 and col. 11, lines 13-17) to enhance the fit of the helmet. The switch contacts are contained within a sealed recess of the earcup (col. 11, lines 24-32).

U.S. Pat. No. 2,844,820 issued to Austin et al. on July 29, 1958 relates to a cap with visor (col. 2, lines 24-27). The cap includes earflaps which may incorporate telephone or radio receiver earphones (col. 4, lines 40-43). The area around the ears is cut out to accommodate the ear flaps.

U.S. Patent No. 4,720,764 issued to Lucas on January 19, 1988 relates to a grounding conductor including an electrically conductive Velcro® strap (col. 2, lines 8-10).

U.S. Patent Nos. 1,085,916 to Hutchinson, 1,354,524 to Timmons, 1,479,017 to Timmons, 3,178,723 to Aileo, 3,422,224 to Curran, 3,477,067 to Aileo, 3,845,389 to Phillips et al., 4,471,174 to Nava, 4,538,034 to French, 4,788,724 to Lazzeroni et al., 4,791,372 to Kirk et al., 4,856,089 to Horton 5,148,887 to Murphy, and 5,218,577 to Seager disclose various communications and related devices.

There exists a need for a lightweight, soft flexible headgear which may be adapted to fit a variety of head sizes and which also provides a communications device. A need also exists for an electrical connector which is compact, convenient and simple to use.

5

#### Summary Of The Invention

The present invention broadly contemplates the provision of a personal communications device such as a communication headset, a cellular telephone, a CB radio, a mobile radio, an AM/FM/cassette radio receiver or the like, in a headgear structure. The communications device comprises a headset with earbuds or earphones and a microphone incorporated into an adjustable cap with a bill. The microphone may be located on a boom or on the bill of the cap.

In one particular aspect, the invention contemplates a communications device for use in aviation. Electrical connectors at the cap are comprised of flexible hook and loop Velcro® pads. This electrical connector incorporated into Velcro® pads is used to connect the headgear and communications device to a wire harness adapted to be coupled, in turn, to an intercom jack on the aircraft. The electrical power would be supplied by the aircraft's intercom system or the like.

Electronics and circuitry are integral to the cap and may be incorporated into flexible printed circuit boards which may be located in the bill, the crown and the headband of the cap.

If an infrared link is utilized between an aircraft intercom system and the communications device, a battery may be used to supply power to the electronics of the headgear and communications device. The most preferred type of battery is a flat, flexible battery as is used in instant film packs, such as those sold by Polaroid Corporation for use in their instant cameras.

Alternative embodiments include a walkie-talkie communications device, a communication headset, a cellular telephone, a CB radio, a mobile radio, an AM/FM/cassette radio receiver, a head top computer, or the like incorporated into a cap. The telephone embodiment may include flexible R.F. electromagnetic radiation shielding for the head, voice actuation and wrist band with keypad.

Further, the present invention provides an electrical connector comprised of flexible hook and loop Velcro® pads. This electrical connector

incorporated into Velcro® pads may have a wide variety of applications, in any device requiring a removable electrical connection.

Brief Description of the Figures

- 5       Figure 1 shows a perspective view of a preferred embodiment of the present invention;
- Figure 2 shows a top plan view thereof;
- Figure 3 is a cross sectional view thereof taken along line 3-3 in Figure 2 showing the internal configuration of the present invention;
- 10      Figure 4 is a simplified view of the electrical connector of Velcro® of the present invention;
- Figure 5 is a fragmentary bottom plan view of the present invention illustrating the underside of the visor;
- 15      Figure 6 is a cross sectional view similar to Figure 3 of an alternative embodiment of the present invention;
- Figure 7 is a fragmentary top plan view of a control panel of the present invention to be worn on the wrist;
- Figure 8 is a cross sectional view similar to Figures 3 and 6 of an alternative embodiment of the present invention; and
- 20      Figure 9 is a top plan view of an electrical connector of Velcro® according to the present invention.

Detailed Description of the Invention

While this invention may be embodied in many different forms, there  
25 are described in detail herein specific preferred embodiments of the invention. This description is an exemplification of the principles of the invention and is not intended to limit the invention to the particular embodiments illustrated.

In one particular aspect, the invention contemplates a communications device for use in aviation. Alternative embodiments include a walkie-talkie  
30 communications device, a cellular telephone, a head top computer, or the like incorporated into a cap. Radio and musical reception in addition to personal communications may be incorporated into the same device.

Referring to Figure 1, the present invention shown generally at 10 provides a communications device in a headgear structure for use in aviation. Although the communications device could be incorporated into any flexible hat with a brim, the most preferred type of cap, as shown, is an adjustable baseball-style cap 5 with a visor. Cap 12 has an interior portion 14 and an exterior portion 16, a top 18 and front and rear portions 20, 22. Cap 12 further includes a bill 24 located at front portion 20, a crown 26 and an adjustable headband 28 located in interior portion 14. As shown in Figure 2, the crown 26 shown comprises four triangular shaped panels including a front gore 30, a back gore 32, a left gore 34 and a right gore 36 sewn 10 together. Optional button 40 is located at the top 18 of cap 12 where gores 30, 32, 34, and 36 meet.

The communications device located in cap 12 has several components, and includes a boom mounted electret microphone 50 pivotally mounted to headband 28 by means of pivot 52, located in interior portion 14 of cap 12. As an alternative 15 to boom mounted electret microphone 50, a highly directional super cardioid or "shot gun microphone" 54, capable of canceling out ambient noise can be incorporated into bill 24 of cap 12.

Left and right ear pieces or receivers 60, 62 containing a speaker transducer are connected to and extend from flexible conductor shaft 64 connected to 20 flexible circuit board 66 preferably located in headband 28. Those skilled in the art would be capable of adapting the circuitry of an ordinary communications device to fit into at least one single or multiple layer flexible circuit board which may fit in a headband. Further, depending upon the manufacture of the microphone boom assembly a simple circuit may be used which would not require a separate circuit 25 board.

Ear pieces or receivers 60, 62 containing a speaker transducer may be ear buds or ear phones which hang from their respective flexible conductor shafts 64 which extend from headband 28. Flexible conductor shaft 64 may be attached in such a manner as to allow for swinging up and out of the way, in a manner similar 30 to that of pivotally mounted electret microphone boom 50. For increased strength and protection from inadvertent breakage, the conductors may be contained within flexible outer sheaths. Cap 12 may include a pocket, Velcro® fastener or other snap means (not shown) to secure earplugs 60, 62 out of the way when not in use.

Ear piece  
Cap piece

Pre-amp 68 is located at headband 28 of cap 12. A volume control actuator 70 and an on-off switch 71 are also located adjacent or on headband 28.

- Controls for volume, channel or frequency selection could also be placed on bill 24 of cap 12 and as shown in Figures 2 and 5 may include an LED 72  
5 ~~and a membrane switch 74~~ for low profile and visual recognition. Controls only requiring tactile manipulation and interpretation such as volume control 70 may be placed on the sides or elsewhere on the cap structure. Control 71 may operate as a switch for controlling the communications device. The switch mechanism itself may, for example, be of a generally conventional type known as a double pole  
10 double throw switch including plural fixed and movable contacts having three positions. For instance, the switch may have a first position connecting the equipment for radio communication, a second position connecting the equipment for local telephone communication, and an intermediate position to monitor both the radio and local phone communication systems. Appropriate connections are made  
15 from control 71 to ear pieces or receivers 60,62 containing a speaker transducer, and microphone 50.

The wires leading from the switch contacts to ear pieces or receivers 60,62 are contained in flexible circuit board 66 preferably located in headband 28. The microphone wires are also connected to the flexible printed circuit board 66 in  
20 headband 28.

As shown in Figures 1 and 4 respectively, first electrical connector 80 and second electrical connector 82 comprise a pair of matable Velcro® pads which include a plurality of electrical contacts 84. While the embodiment providing two-way communication requires four contacts per pad, a minimum of two contacts may  
25 be used where two-way communication is not required. Each contact may also provide more than one function, thereby enabling there to be fewer contacts. For example, one electrical contact per connector may be provided. Greater than four contacts may also be used. Contacts for the transmitter, the receiver, a power source and ground are shown. First electrical connector 80 is fixedly located at  
30 exterior portion 16 of cap 12. Second electrical connector 82 is adapted to mate with first electrical connector 80. Second electrical connector 82, shown in Figure 4, extends from quick disconnect cable harness 86, which includes microphone and headphone jacks 88,90, respectively, which are connected in turn to an external

communications apparatus such as an intercom jack in an aircraft (not shown). The electrical power would be supplied to the communications device by an aircraft intercom system or the like.

- Electronics and circuitry are integral to the cap and may be
- 5 incorporated into at least one additional flexible circuit board 92 located in crown 26 of cap 12. Alternatively, an additional flexible circuit board may be located in or on bill 24 of cap 12.

- In an alternative embodiment wherein an infrared link between an aircraft intercom system and the communications device is used, a battery is
- 10 necessary to supply power to the electronics of the communications device. The most preferred type of battery is a flat, flexible battery as is used in instant film packs. As shown in Figures 2, 3, 6 and 8, battery 94 is shown located in crown 26 of cap 12.

- Referring to Figures 6 and 7, an alternative embodiment of the
- 15 personal communications device suitable for incorporation into a cap or hat is shown. This embodiment may serve as either a two-way communication device or walkie-talkie, or a cellular telephone. The cellular telephone embodiment may include flexible metalized, active or passive RF or radio emissions shielding 110 to shield the user's head. Shielding 110 is located in interior portion 14 of cap 12 and
- 20 would comprise the portion of interior 14 closest to the user's head, thereby protecting the user from exposure to RF or radio emissions. Shielding 110 may be comprised of flexible conductive material covered by an insulator of plastic or cloth. Shielding 110 may be used alone, comprising gores 30, 32, 34 and 36 of cap 12.
- 25 While to date there are no proven health risks associated with cellular phones, this shielding feature may become more widely used if such a health risk is found to exist. Therefore, this aspect of the device would be a reassurance to those who are concerned about the possible effects of RF emissions and health effects.

- Antenna 114 extends from the outer portion of cap 12 near headband
28. A voice actuation means may be included in flexible circuitry 92. Further,
- 30 referring to Figure 7, the telephone may be controlled by wristwatch control unit 115. Wristwatch control unit 115 includes a keypad 116 on a band 118 to be worn around a user's wrist. Infrared transmitter/receiver 120, located on bill 24 of cap 12 provides a linkage between the wristwatch control unit and the communications

device. The walkie-talkie embodiment has the same components as the cellular phone.

The cellular phone and walkie-talkie or mobile radio embodiments of the invention may incorporate either analog or digital transmitting and receiving means. Digital would provide more privacy (encoding and decoding the transmissions), greater clarity and would be able to accommodate more data. The communications device of the present invention could also include a paging beeper, homing or locator services.

Referring to Figure 8, in combination with Figures 1, 2, 4 and 5, a head top computer is shown which may include all components described above, in addition to those additional components shown in the Figures. CCD disk drive compartment 96 and membrane keyboard 74 are located at bill 23 of cap 12, as shown in Figures 1 and 2. In an embodiment where the communications device includes a computer, the MD disks thereof could fit into disk drive compartment 96. Controls for volume, channel or frequency selection may be placed on the bill of the device and may include LED's and membrane switches for low profile and visual recognition. Controls only requiring tactile manipulation and interpretation could be placed on the sides or elsewhere on the device, as with volume controls 70. Membrane keyboard 74 may include LED indicator 72, as shown in Figure 5. Such head top computers may also include voice recognition capabilities incorporated in flexible circuit board 92, which take the place of keyboards or the script recognition utilized by PDA or personal digital assistants. CRT-projector 130 and infrared transmitter/receiver 120 are located on bill 24 of cap 12. Visor 132 attached to and extending downwardly from bill 24 of cap 12 provides a means by which a CRT projection is viewed by the user. Eye movement sensor 134 provides an alternative means by which the head top computer is controlled. Wristwatch control unit 115 may also be used to control the head top computer, via infrared transmitter/receiver 120. The embodiment shown in Figure 8 may also include shielding 110.

Radio and musical reception in addition to personal communications may be incorporated into the same device. This includes any or all the following: AM/FM radio, stereo, cassette (analog), cassette-digital (DCC), compact disc, mini compact disk (MD), DAT and any of the several high fidelity electronic music formats either currently under development or which will be developed over the

course of this patent. These entertainment devices may be controlled by volume control 70 and membrane keyboard 74.

Optionally, controls for head top computers, cellular phone or other communications devices requiring more visual and manual controls could employ a 5 control unit such as a key pad either worn on the wrist or incorporated into clothing on lower arm or thigh and such key pad would be either connected via wire harness or wireless - RF or an infrared link.

The present invention may also incorporate various electronic personnel communication and other devices into apparel, caps and hats or other 10 clothing worn by an individual. For example, it could alternatively be configured in a baseball cap or the type of uniform hat that airline pilots, police and military personnel employ, in addition to a cowboy hat, a Stetson type of felt hat, or a women's high fashion hat.

The cap-mounted communications device of the present invention 15 could also be applied as electronics incorporated into individual uniforms, i.e., police SWAT team or a military uniform jacket or bullet proof vest.

The communications device may be connected in the use for aircraft pilot use by a cable connected by the connector incorporated into Velcro® pads of the type heretofore described or other types of connectors. Alternatively, the 20 communications device may be connected in a wireless manner for aircraft pilot use by an infrared link to a receiver connected to the aircraft's intercom and radios.

Referring to Figure 9, an electrical connecting means according to the present invention is shown. The electrical connecting means shown generally at 170 comprises a first electrical contact pad 180 and a second electrical contact pad 182 of matable Velcro®. In the embodiment shown, first electrical contact pad 180 includes four electrical contacts, 184, 186, 188 and 190, and second electrical contact pad 182 includes four electrical contacts 184', 186', 188' and 190'. Electrical contact pairs 184-184', 186-186', 188-188', 190-190' four electrical contact pairs 184-184', 186-186', 188-188', 190-190' are formed as 30 first and second electrical contact pads 180, 182 are mated, thereby establishing an electrical connection. Although four electrical contact pairs are shown, the electrical connector may include from as little as one electrical contact pair to as many pairs as are required. Velcro® of electrical contacts 180,182 holds electrical contact pairs

184-184', 186-186', 188-188', 190-190', firmly in place, completing the electrical circuit. Electrical connector 170 may be used in any device which requires electrical contacts.

The present invention achieves several objectives and advantages.

- 5 Present cellular phones and other personal communication systems and wireless products require the user to hold the device while using them. The user may also be exposed to RF or radio emissions. The present invention provides a "hands-free" communications device.

Other advantages include the portability of the device, which can go

- 10 essentially anywhere and provide a communications device, an entertainment product, a computer or the like. Further, in comparison to previously manufactured headsets and helmets, the present invention is neither uncomfortable nor cumbersome. It is lightweight, comfortable and convenient.

Further, the electrical connector disclosed is convenient and easy to

- 15 use, making it suitable for a multitude of applications.

The above Examples and disclosure are intended to be illustrative and not exhaustive. These examples and description will suggest many variations and alternatives to one of ordinary skill in this art. All these alternatives and variations are intended to be included within the scope of the attached claims. Those familiar  
20 with the art may recognize other equivalents to the specific embodiments described herein which equivalents are also intended to be encompassed by the claims attached hereto.

What is claimed is:

1. A communications system comprising:
  - a) a hat comprising a crown and a headband; and
  - b) a communications device located in said hat, the
- 5 communications device further comprising:
  - i) circuitry arranged on a flexible circuit board disposed in said hat;
  - ii) a power source coupled to the circuitry;
  - iii) means for a user to receive sounds extending from said hat; and
  - 10 iv) means for a user to transmit sounds.
2. The communications system of claim 1 wherein:
  - a) the hat further comprises a crown, and a bill;
  - b) the means for a user to transmit sounds is a transmitter attached to the hat; and
  - 15 c) the circuitry arranged on a flexible circuit board is located in the headband of the hat.
3. The communications system of claim 2 further comprising means for connecting the transmitter and receiver to a control panel.
- 20 4. The communications system of claim 3 wherein the means for connecting the transmitter and receiver to a control panel comprises an electrical connecting means further comprising a pair of flexible mated Velcro® pads, said pair of Velcro® pads comprising:
  - a) a first Velcro® pad fixed to the crown of the cap or head piece 25 at an outer portion thereof and including at least two electrical contacts thereon; and
  - b) a second Velcro® pad including at least two electrical contacts thereon, said second Velcro® pad being removably connectable to the first Velcro® pad and extending from a multi-conductor cable cord which is removably connectable to an intercom jack of the control panel;
- 30 whereby, when the first and second Velcro® pads are mated, electrical contact is established between the electrical contacts on the first pad and corresponding electrical contacts on the second pad.

5. The communications system of claim 4 wherein the power source is an electrical contact pair formed by an electrical contact from the first Velcro® pad and an electrical contact from the second Velcro® pad.

6. The communications system of claim 3 wherein the transmitter and  
5 receiver are connected to a control panel by an infrared link, and the power source is a battery located in the crown of the hat.

7. A communications device for use in aviation and other applications comprising:

- 10 a) a cap or head piece;
- b) a transmitter attached to said head piece; and
- c) at least one receiver attached to said head piece.

8. The communications device of claim 7 wherein the cap or head piece further comprises a crown, a headband and a bill, said communications device further comprising:

- 15 a) a power source; and
- b) means for connecting the transmitter and receiver to a control panel.

9. The communications device of claim 8 wherein the means for connecting the transmitter and receiver to a control panel is an electrical connecting  
20 means comprised of a pair of flexible mated Velcro® pads comprising:

- a) a first Velcro® pad fixed to the crown of the cap or head piece at an outer portion thereof and including at least two electrical contacts thereon; and
- b) a second Velcro® pad including at least two electrical contacts thereon, said second Velcro® pad being removably connectable to the first Velcro®  
25 pad and extending from a cord which is removably connectable to an intercom jack of the control panel;

whereby, when the first and second Velcro® pads are mated, electrical contact is made between the electrical contacts on the first pad and corresponding electrical contacts for the second pad.

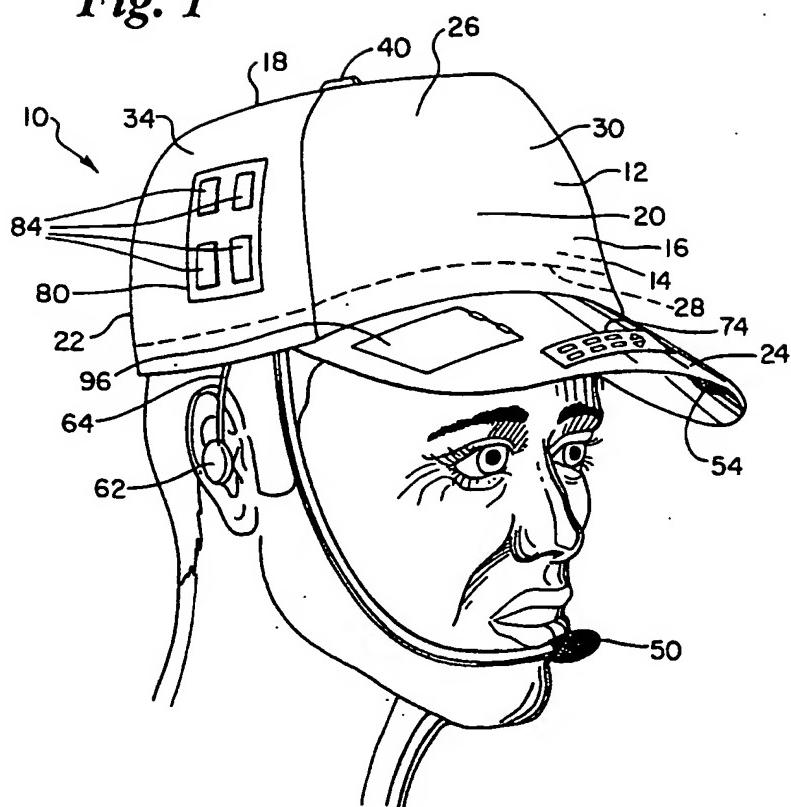
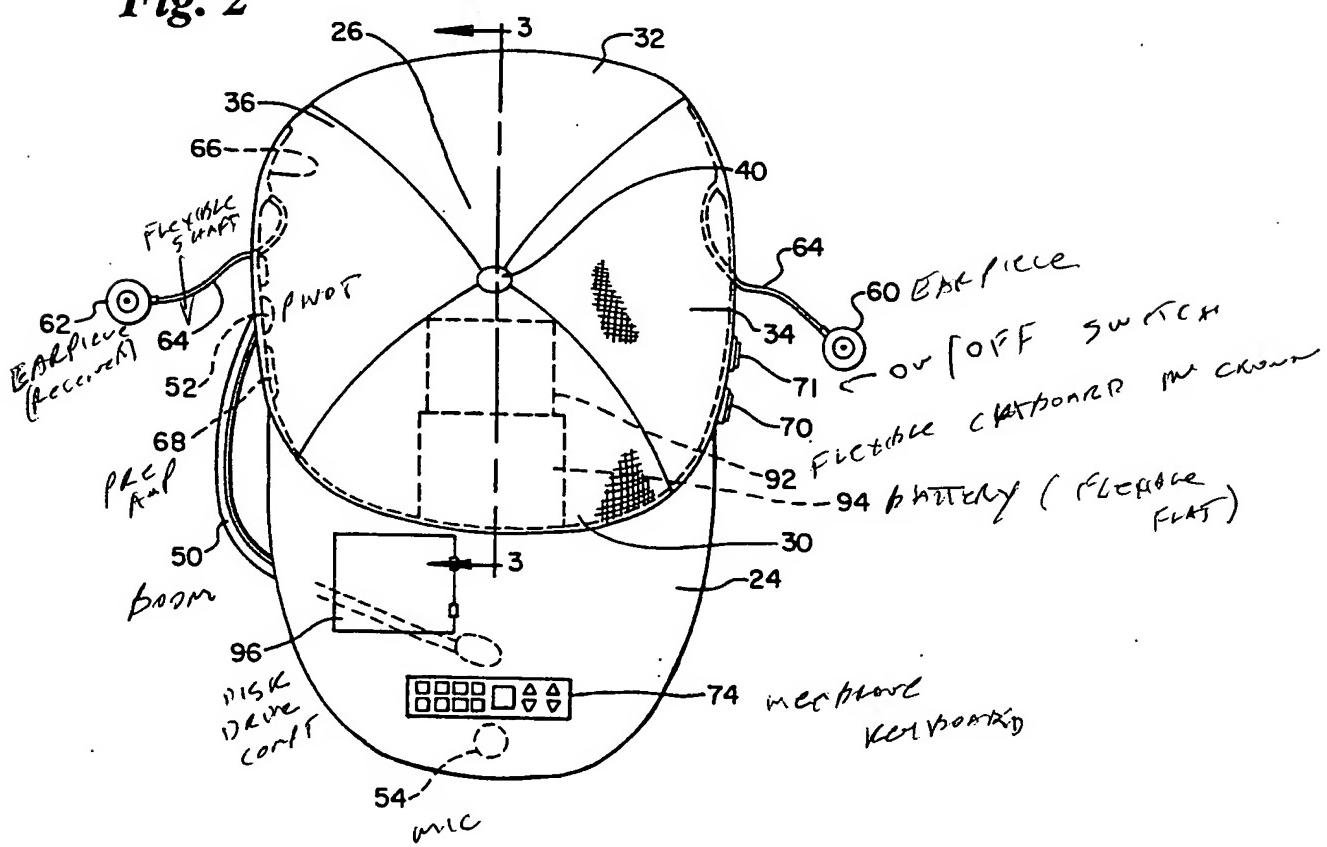
- 30 10. The communications device of claim 8 wherein one electrical contact of the first Velcro® pad is connected to the transmitter, one electrical contact of the first Velcro® pad is connected to the receiver, one electrical contact of the first Velcro® pad is connected to a power source and one electrical contact is a ground.

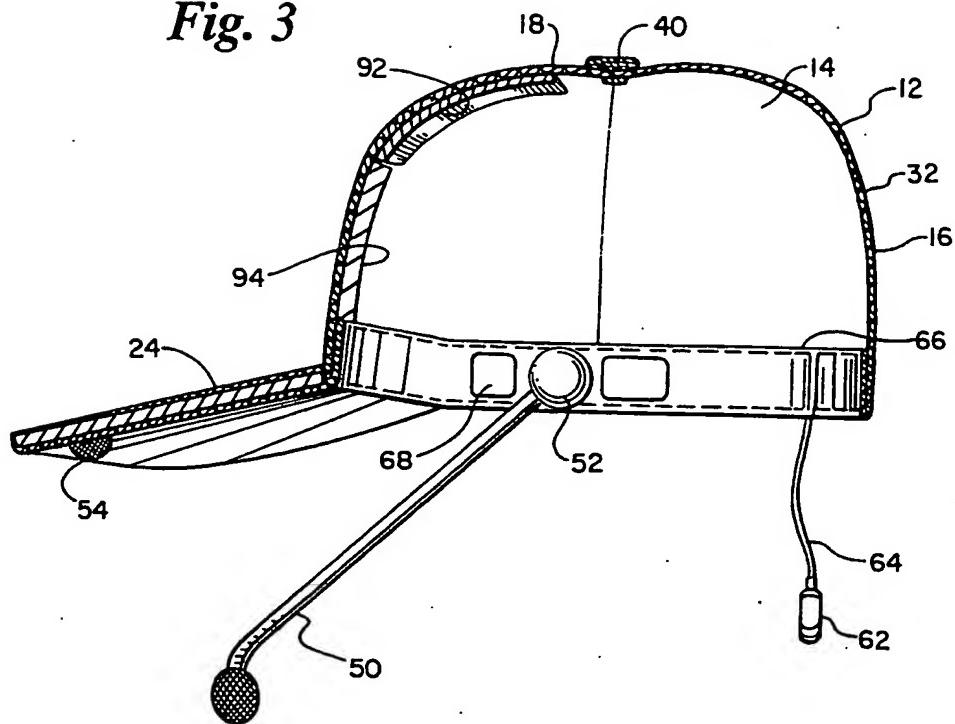
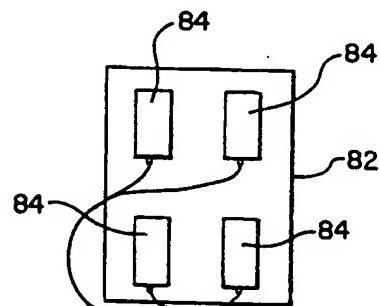
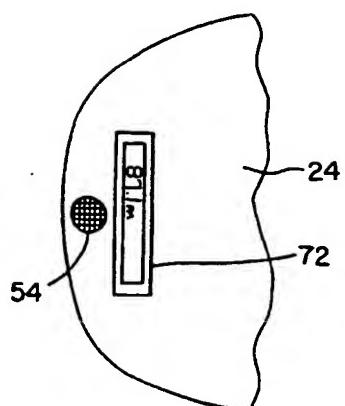
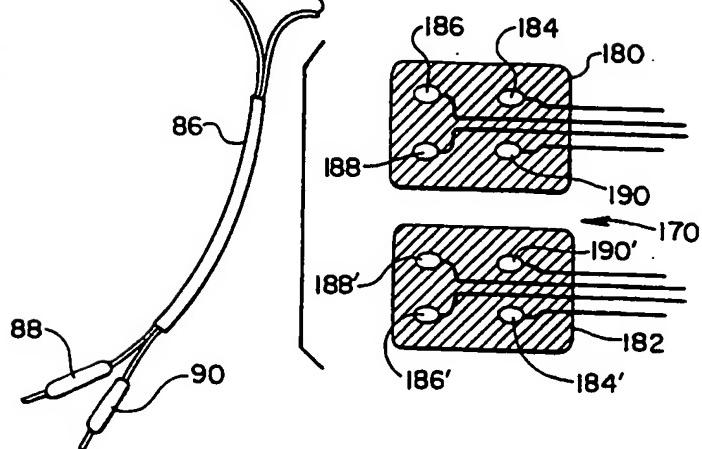
11. The communications device of claim 8 wherein the means for connecting the transmitter and receiver to a control panel is an infrared link, and the power source is a flexible battery located in the crown of the cap or head piece.
12. The communications device of claim 8 wherein said receiver 5 comprises a headset with earbuds and said transmitter comprises a boom microphone.
13. The device of claim 12 further including:
  - a flexible means for shielding a user from radiation located in the crown of the cap or head piece; and
- 10 14. The device of claim 13 wherein the cellular telephone is operated by means of a keypad located on a separate wristband.
15. The device of claim 12 further including a portable computer carried thereon, with a disk drive located at the bill of the cap or head piece.
16. The device of claim 15 further including a control unit located on a separate wristband or incorporated into an article of clothing.
17. The device of claim 8 further including a stereo/radio entertainment device.
- 20 18. The device of claim 9 further including:
  - a control for volume; and
  - a channel or frequency selector located on the bill of the cap or head piece.
19. An electrical connecting means comprising a first contact pad and a 25 second contact pad being removably connectable by means of Velcro®, the first contact pad further comprising at least one contact and the second contact pad further comprising at least one contact, said contacts being constructed and arranged to mate when the contact pads are connected, and said second contact pad further comprising means for attachment to a control panel extending from the second contact to the control panel.
20. An electrical connecting means comprising a first flexible Velcro® pad fixed to an article of wearing apparel, a second flexible Velcro® pad being removably connectable to the first member and including means for attachment to a

-13-

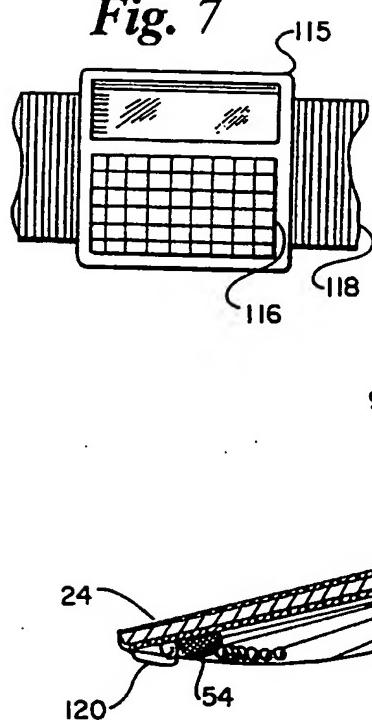
control panel, the first Velcro® pad further comprising at least one electrical contact and the second Velcro® pad further comprising at least one electrical contact, the electrical contacts being constructed and arranged to mate when the Velcro® pads are mated, thereby establishing electrical connection.

- 5 21. The connecting means of claim 20 wherein each Velcro® pad comprises four electrical contacts which mate when the Velcro® pads are mated.

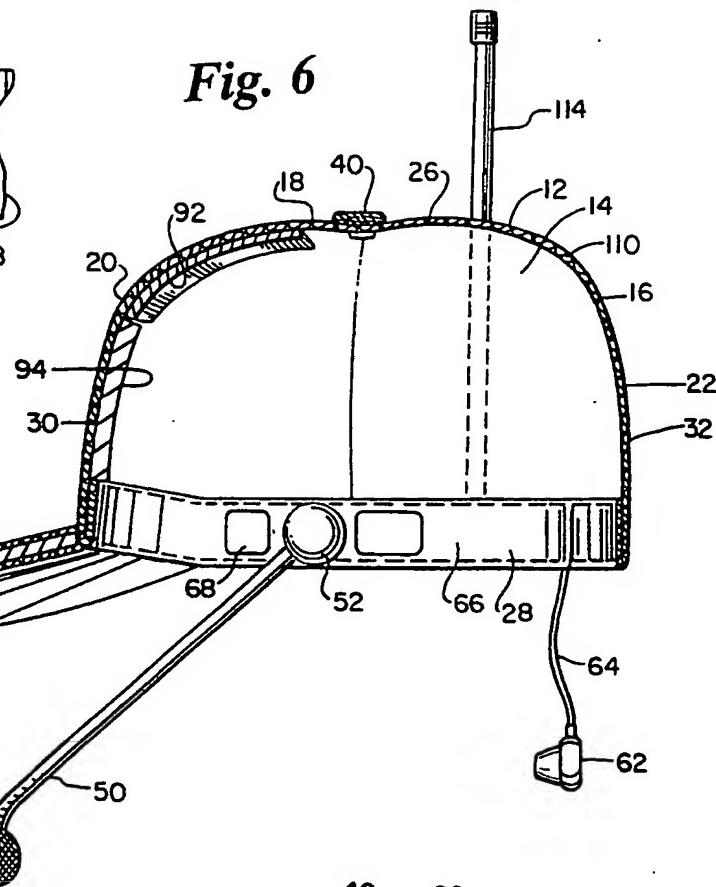
*Fig. 1**Fig. 2*

*Fig. 3**Fig. 4**Fig. 5**Fig. 9*

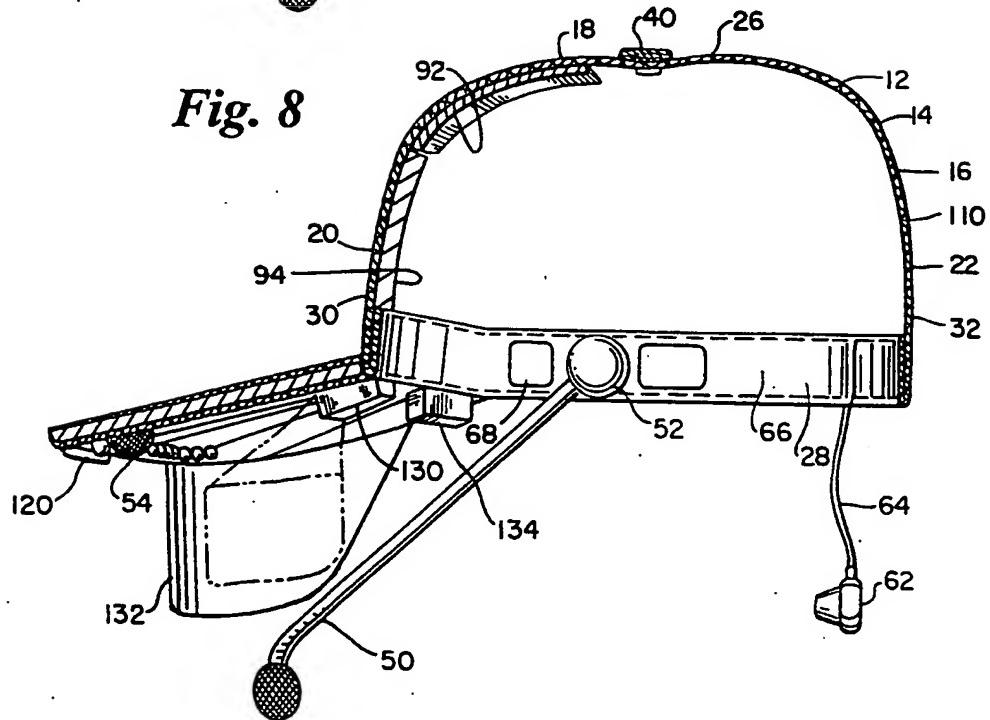
*Fig. 7*



*Fig. 6*



*Fig. 8*



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US94/13264

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :H04B 1/38, 1/06, 1/08

US CL :455/90, 344-351

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 455/89-90, 344-351

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4,191,950 (LEVIN ET AL) 04 March 1980, fig. 2.	19
Y		4-5, 9-10, and 20-21
Y	JP, A, 5-63625 (SAWADA) 12 March 1993, fig. 2.	1-14 and 17-18
Y	US, A, 4,340,972 (HEIST) 20 July 1982, fig. 2, col. 3, lines 25-34.	1-14 and 17-18
Y	US, A, 4,977, 619 (CRIMMINS) 11 December 1990, fig. 1, col. 3, lines 37-42).	6 and 11
Y	US, A, 4,648,130 (KUZNETZ) 03 March 1987, fig. 2.	12-13

 Further documents are listed in the continuation of Box C.

See patent family annex.

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Date of the actual completion of the international search

16 FEBRUARY 1995

Date of mailing of the international search report

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## INTERNATIONAL SEARCH REPORT

International application No.

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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 5,239,521 (BLONDER) 24 August 1993, fig. 1.	14
Y	US, A, 4,864,619 (SPATES) 05 September 1989, fig. 1 and fig. 3.	17-18